

41st Argos Operations Committee Meeting

Saint-Jean-de-Luz, FRANCE

June 5th to 7th, 2007

D-3 -Status of Argos Instruments in-orbit - CNES

ARGOS-1 instruments :

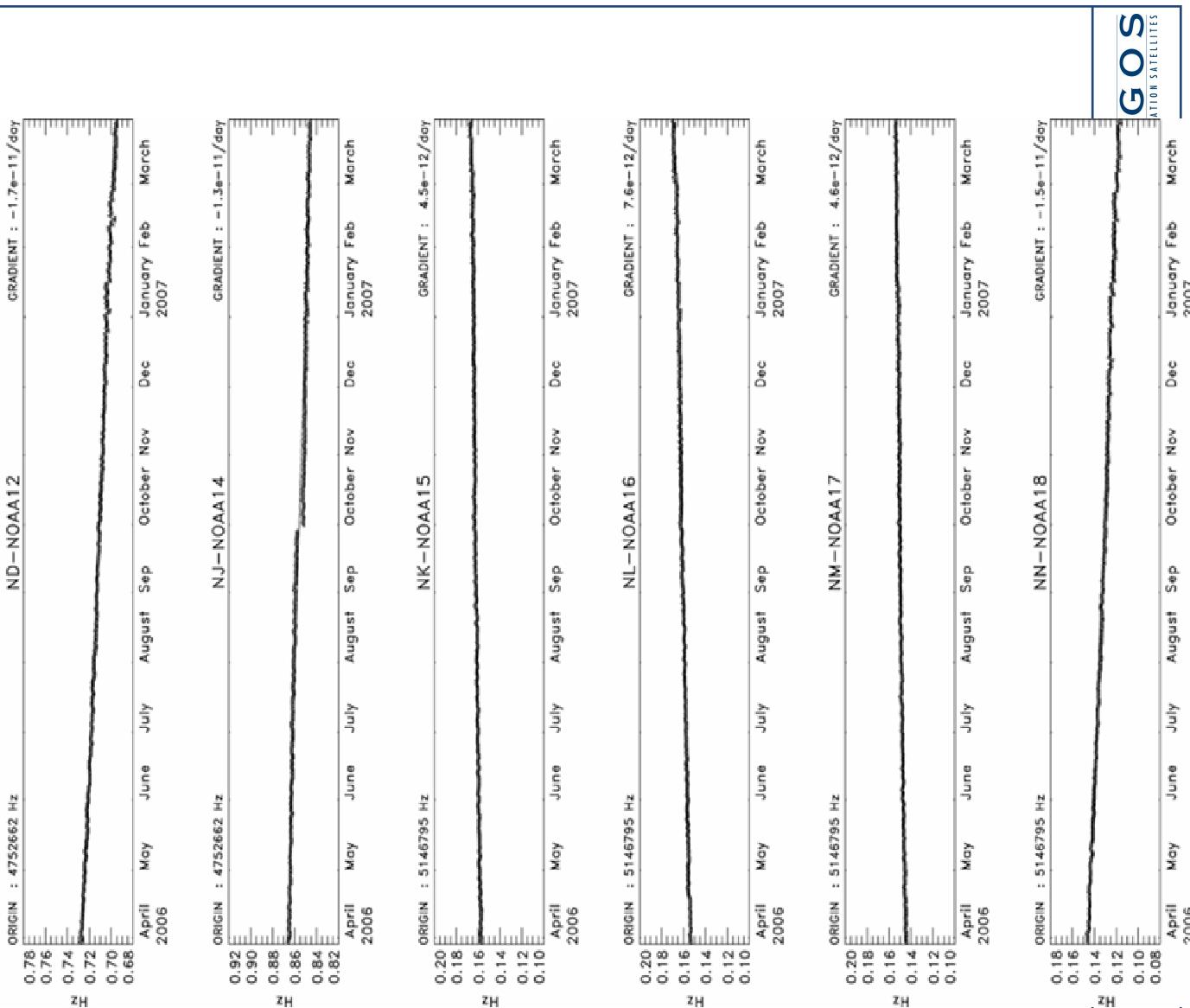
- one instrument is still in service on-board NOAA-12 (1991)
- data retrieved by NOAA only when station availability allows.

ARGOS-2 instruments :

- 4 instruments of second generation (NOAA-15, 16, 17 and 18)
- the processing unit DRU#8 of NOAA-18 is failed : a few percent of messages are lost over the most crowded areas
- bandwidth of 80 kHz (instead of 24 kHz)
- telemetry bit rate = 2560 bits/s
- NOAA-15 to 18 satellites record data on-board, then download them to Fairbanks and Wallops stations.
- HRPT signal of NOAA-16 transmitted in LHCP polarization
- “pseudo-message” mode activated on NOAA-16 allowing to perform narrowband interferer location

USO monitoring on NOAA satellites :

Evolution of onboard USO frequency over 12 months



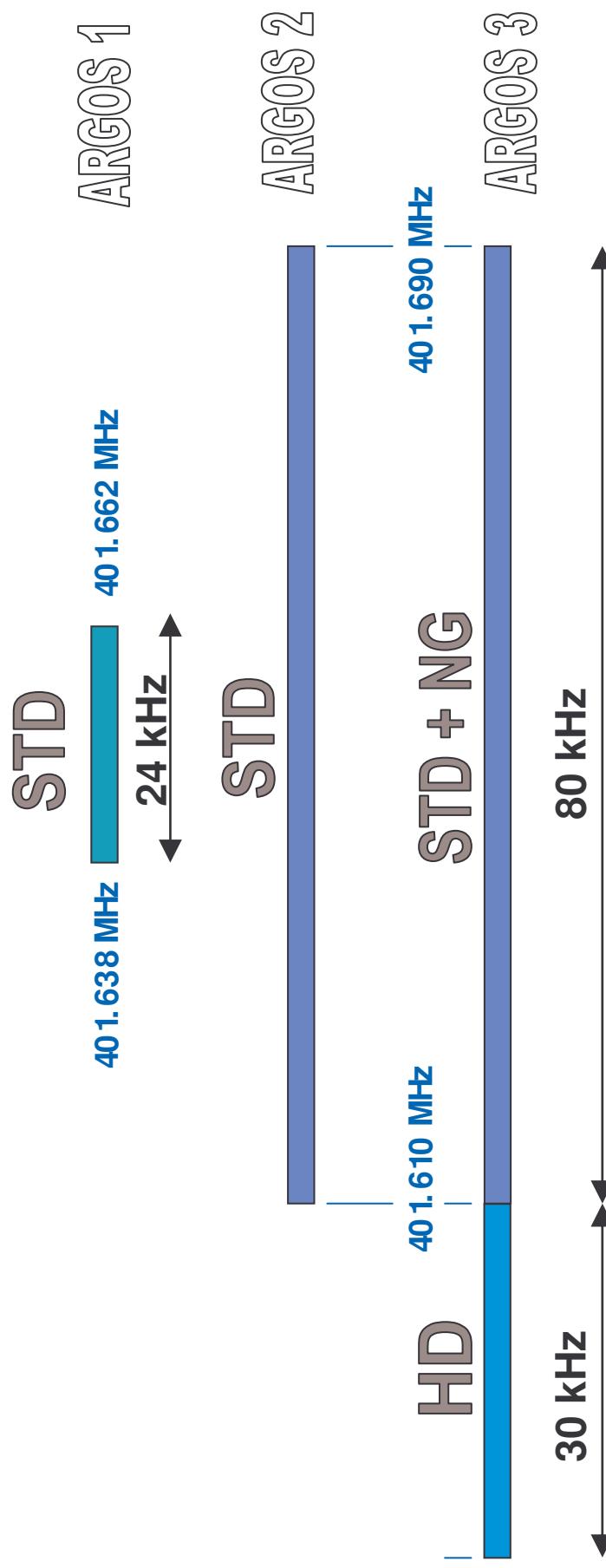
Ultra-Stable Oscillator is particularly monitored by CNES and by CLS since most of the instruments functions are referenced to this clock. More particularly, all time-tagging and frequency measurements depend highly on the oscillator stability.

Gradient ~ 1.10^{-11} /day

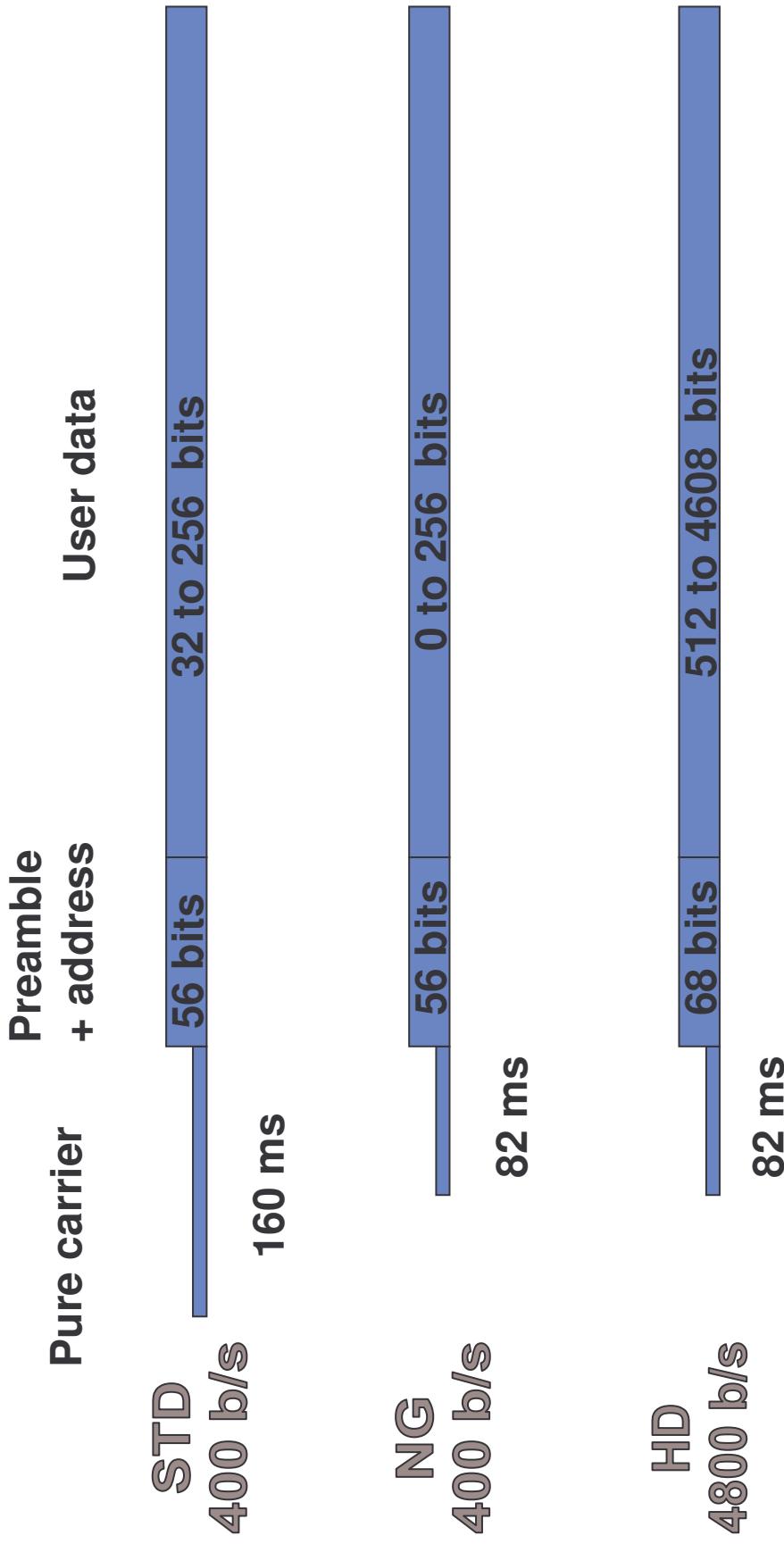
The ARGOS-3 New Generation

- continuity of the system with PTT-A2 platforms
- improve the performance of the system (in term of sensitivity and in term of capacity). The receiving bandwidth is now 110 kHz.
- include a downlink message service to :
 - acknowledge uplink messages
 - transmit broadcasting messages (time, orbit ephemeris)
 - modulate beacon parameters (length of messages, repetition period,)
- introduce new kind of platforms :
 - low-power consumption platforms (improvement of 3 to 4 dB of the uplink margin)
 - high-data rate platforms (4800 bps)

The ARGOS-3 Bandwidth



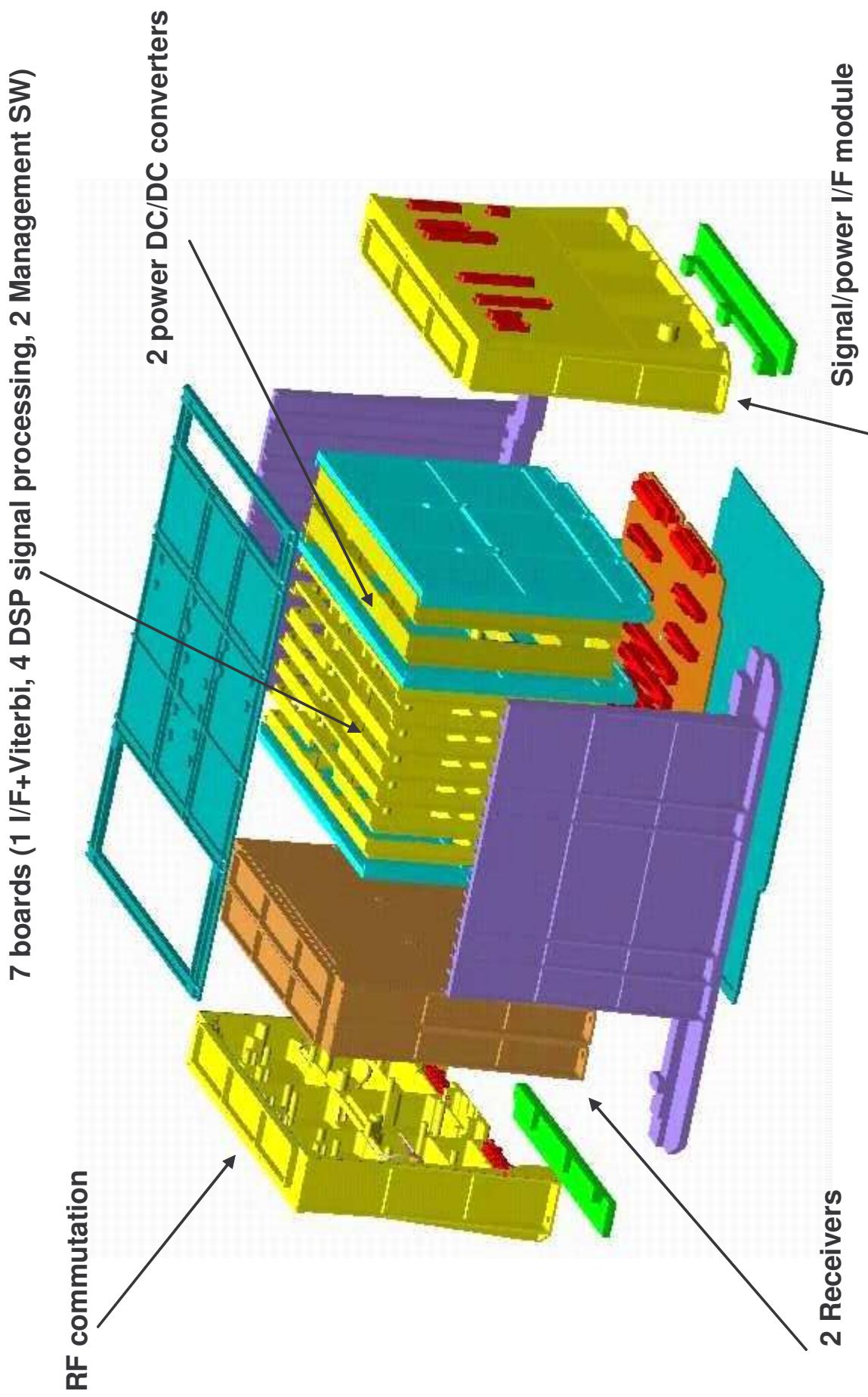
The ARGOS-3 Beacons and Messages



The ARGOS-3 Instrument

- one RPU (Receive Processing Unit) doing :
 - processing of the received uplink messages
 - downlink management
 - interfaces with the TXU, the satellite
- one TXU (Transmitter unit) sending the emissions to the beacons fitted with a receiver
 - cold internal redundancy that can be-activated by TC-LEVEL.
 - use of full digital processing technics on DSP 21020 clocked at 15 MHz
 - new software to manage the downlink
 - use of the « TIROS » interface (NIU)

Exploded view of the Argos-3 RPU

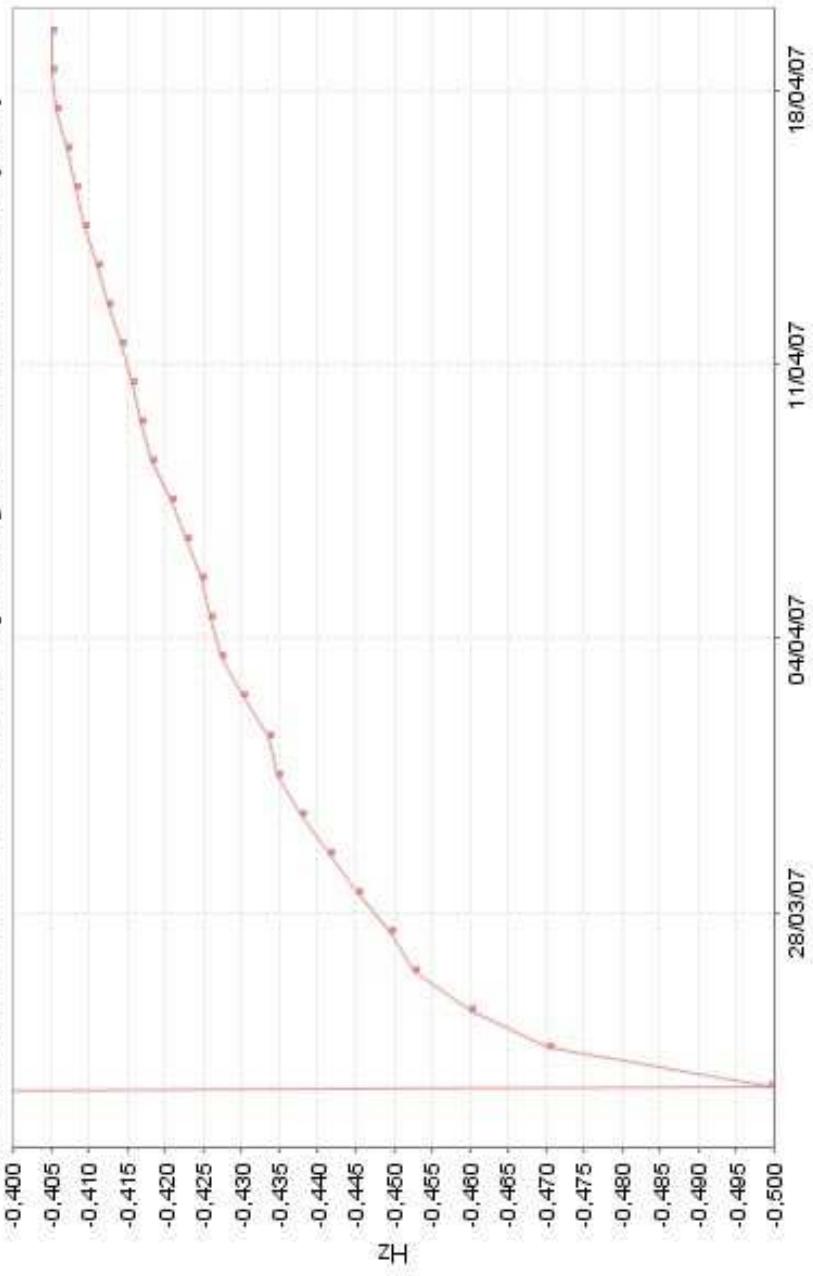


Argos-3 on-board METOP-A

- Flight Model n°2 . Was delivered to Alenia in October 2002.
- Launched from Baïkonour on October 19th, 2006.
- Switch-on of Nominal side on October 26th, 2006 at 7h20 UTC.
 - One main anomaly : mission Telemetry corruption
 - Switch-on of Redundant side on March 22nd, 2007.
- SIOV Review hold in Eumetsat on 28-29 March, 2007.
 - operational procedure to detect TLM corruption asap
 - operational procedure to restart instrument and to upload the patch in case of new occurrence of TM corruption
 - FOM and JORP have been updated consequently
- All is nominal at instrument level from March 22nd.
- Argos-3 is now considered as OPERATIONAL
- Cal/Val report available early June
- Ready for Cal/Val Review (or Validation Product Review)

USO (OCXO) monitoring on METOP-A

Evolution of onboard USO frequency over 12 months (mA)



for METOP, gradient $\sim 1.10^{-10}/\text{day}$

Telemetry Corruption Anomaly

- the corruption of Mission Telemetry occurred 4 times : 22/11/06 01/01/07
29/01/07 13/03/07

- when there is corruption, all other functions are nominal (HK parameters, uplink/downlink functions, protocol
- Management SW and Processing SW work properly and cannot be the cause of the anomaly
- a restart of the instrument is required to recover a nominal Telemetry : the full recovery of nominal configuration takes about 12 hours.
- a CNES/THALES expert group in charge of investigation raised the conclusion that the cause of the anomaly is due (the most likelihood) to a deficiency of the A-DCS FIFO (R/W pointers and/or flags logic)
- through electrical tests performed on 3 pieces of the flight lot, it has not been found any specific failure or dysfunction, but the FIFO have been considered as sensitive and potentially could enter to an unstable mode depending on input signals and power lines..

see Argos-3 Cal/Val phase slides



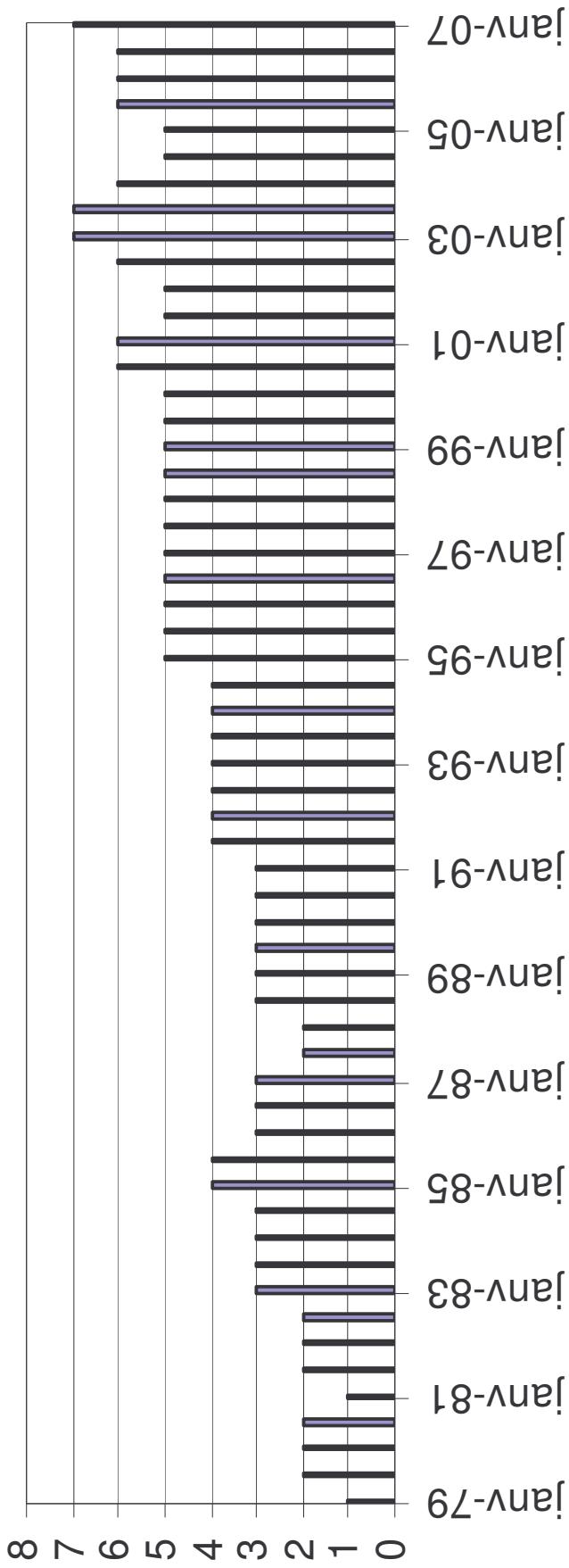
Statement of Argos instruments in-orbit

Satellite	Launch date	End	Duration (days)	Duration (year)	Comment
Tiros-N	13/10/1978	27/02/1981	868	2,4	prototype
NOAA-A	27/06/1979	31/03/1987	2834	7,8	
NOAA-B	29/05/1980	29/05/1980	0	0,0	launch failed
NOAA-C	23/06/1981	01/06/1986	1804	4,9	
NOAA-D	14/05/1991	31/05/2007	5861	16,1	3 orbits/day
NOAA-E	28/03/1983	29/12/1985	1007	2,8	proto Advanced Tiros-N
NOAA-F	12/12/1984	13/02/1998	4811	13,2	
NOAA-G	17/09/1986	30/08/2001	5461	15,0	
NOAA-H	24/09/1988	16/06/2004	5744	15,7	stopped on 16/6/04
NOAA-I	09/08/1993	21/08/1993	12	0,0	short-circuit on board
NOAA-J	30/12/1994	23/05/2007	4527	12,4	stopped on 23/05/07
NOAA-K	13/05/1998	31/05/2007	3305	9,1	operational
NOAA-L	21/09/2000	31/05/2007	2443	6,7	operational
NOAA-M	24/06/2002	31/05/2007	1802	4,9	operational
ADEOS II	29/01/2003	25/10/2003	269	0,7	failure of solar panel
NOAA-N	20/05/2005	31/05/2007	741	2,0	operational
METOP-A	19/10/2006	31/05/2007	224	0,6	IOC (Initial Operation Capability)
		Total	41489	113,7	

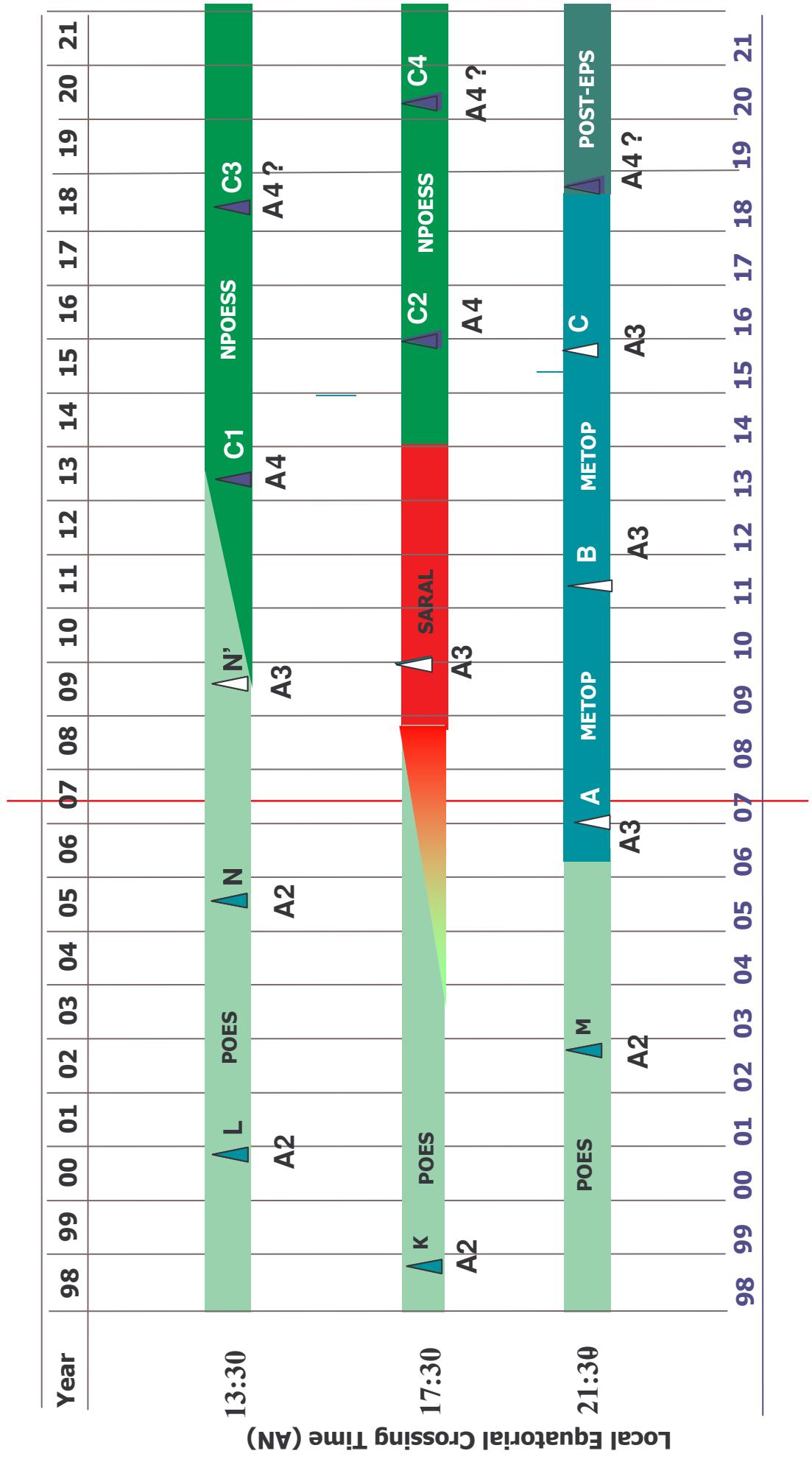
more than 113 years in orbit



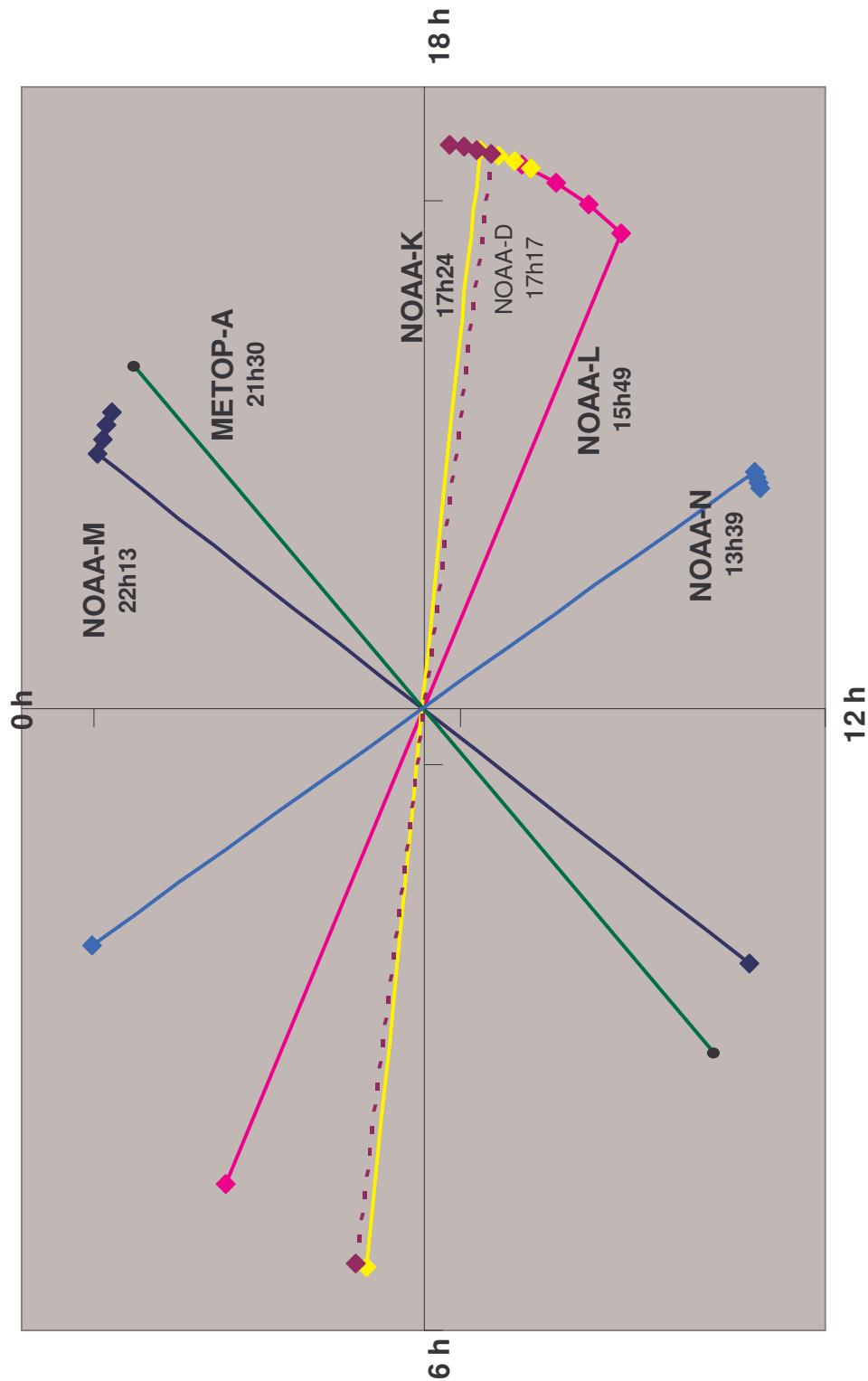
Number of instruments in-orbit



Argos Instruments Deployment



Equator crossing time (May 07) plus drift in 6, 12, 18 months



Equator crossing time (end of 2009)

